A Housing Energy Management Program Report

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REPORT ON THE ENERGY MANAGEMENT INSTALLATION AT 1765 WESTON ROAD

Project undertaken jointly by the Ontario Ministries of Municipal Affairs and Housing and Energy under the Housing Energy Management Program (H.E.M.P.)

Prepared for the Ministry of Municipal Affairs and Housing, Research and Development Section

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A. EXECUTIVE SUMMARY

1. An experimental computerized energy management system for control of space heating and ventilation was retrofitted to a high rise gas-heated apartment building.

2. The performance of the experimental energy management system was evaluated by comparing the experimental building to a similar building with a standard control system on an ongoing basis and with its own operating history prior to installation of the experimental system.

3. Evaluations by both the above methods show that savings were achieved, particularly during mild weather in the heating season.

4. The payback period for an energy management system without the extra metering required for this experiment is approximately two years.

5. The ability to save is dependent upon the ability to cut back the heating system when the building is warm.

6. An increase in electrical consumption of three percent can be expected as some tenants augment their heat.

B INTRODUCTION

In September 1981 an experimental computerized energy management system for control of space heating, ventilation, and domestic hot water was installed in a highrise gas-heated apartment building. The project was undertaken jointly by the Ontario Ministries of Municipal Affairs and Housing and Energy under the Housing Energy Management Program (H.E.M.P.). Two architecturally identical buildings owned by Meridian Property Management (308182 Ontario Limited) were selected for the experiment; 1765 Weston Road as the demonstration building and 1775 Weston Road as the control. Equipment was installed in each building to monitor space heating and domestic hot water temperatures, corridor supply and building exhaust air temperatures. York Hydro and Consumers Gas installed pulse generating equipment in the metering systems of each building to allow remote monitoring of hydro and gas consumption by ADMIC equipment. At 1765 Weston Road the space heating water and intake air temperature set points and fan operation were put under the control of ADMIC Controls' Central Station computer.

Historical data from energy bills for the two buildings for four years prior to September 1981 was summarized and compared on a season-by-season and

temperature-by-temperature basis. Energy use was found to be similar, but with some systematic differences that may be attributed to a recreational facility which drew its gas from 1775 Weston Rd and its hydro from 1765 Weston Rd.

Installation work at 1765 Weston Road commenced in the spring of 1981 and control of the space heating system was assumed in October 1981. Owing to mechanical problems with the pulse generating equipment the early pulse counter results were unreliable.

Both 1765 and 1775 Weston Road are 24-storey, brick and concrete, adult apartment buildings containing 245 and 246 suites respectively. The principal energy source is gas, with four Rheem electric ignition boilers, each 2,000,000 BTUH, providing suite heating and ramp heating in each building. Two Ruud boilers, each 1,216,000 BTUH, heat glycol loops which in turn preheat the corridor intake air to each building. Domestic hot water is provied by two Ruud boilers, each 736,000 BTUH. The gas metering at 1775 Weston Road includes two additional boilers devoted to the recreation center between the two buildings, a 2,000,000 BTUH unit for heating the swimming pool and a small boiler providing hot water for the showers. The electric feed to the recreation center is metered with 1765 Weston Road.

Each building has five exhaust fans of 2 hp and a

single intake fan of 10 hp.

In the course of this demonstration ADMIC took control of the space heating, air preheating, and domestic hot water temperature set points at 1765 Weston Road. To achieve finer control of the air preheating the controls for the two boilers were separated so that they could be stepped rather than having to be both on or both off. Ventilation was controlled by cycling the exhaust fans and switching the intake fan on or off according to the outside temperature and time.

This report is based on:

a) The Admic Control System setpoints and the building performance as monitored and logged by the ADMIC Central Control and Monitoring System from March 1982 to March 1983.

b) The York Hydro and Consumers Gas bills for 1765 and 1775 Weston Road

c) ADMIC's experience at dealing with various engineering, adjustment and human problems which had to be addressed to make the system fully operational and optimum in performance.

C. ENERGY HISTORY AND SAVINGS

The historical energy use as reported on the utility bills consists of the energy used within each of 1765 and 1775 Weston Road and the energy used in the recreation facility located between them. The gas consumed by the recreation center is included in the 1775 Weston Road bills, the electricity in the 1765 Weston bills. The average rate (R) of energy use during a billing period can be related to the average outdoor temperature (T) during a billing period by an equation of the form:

$$R = m \times T + B$$

where m and B represent the slope and intercept respectively of the straight line obtained by a least squares treatment of all the historic data available for the same season. Values of m and B for gas and hydro consumption for 1765 and 1775 Weston Road are listed in Tables 1, 2 and 3 on Pages 7 and 8. The raw data from which the slopes and intercepts were determined are listed in Appendices A. (gas) and B. (hydro). The differences in historical energy consumption are attributed to the recreation facility, and have been used to project its energy consumption during this project.

The energy saved through conservation measures was

determined both by monitoring the energy used by two otherwise identical buildings on an ongoing basis and by comparing the current energy consumption with a "historic" value obtained by projecting the historic patterns of energy consumption for that building to the current weather conditions. If the control building maintained the same energy use efficiency as in the historic period, the savings calculated by the two methods above would be equal. The difference between the two sets of results is an efficiency of measure of the deterioration in the control building.

Table 1: Constants relating historic rate of gas use to temperature at 1765 and 1775 Weston Rd

Season	1775 Weston Control Bldg.		1765 Weston Demo Bldg.	
	m (mcf/deg/day)	B (mcf/day)	m (mcf/deg/day)	b (mcf/day)
Jan-Mar	-2.95	110.65	-3.05	101.39
Apr Jun	-4.76	104.56	-4.05	88.61
July-Sep	-0.79	32.92	-0.29	16.42
Oct-Dec	-5.81	113.81	-5.12	97.07

Table 2: Constants relating historic electricity consumption to average outdoor temperature at 1775 and 1765 Weston Road

Season	1775 Weston		1765 Weston	
	m (kw/deg)	B (kw)	m (kw/deg)	B (kw)
Jan-Mar	-2.36	182.41	0.26	226.3
Apr-Jun	-2.04	201.06	0.24	191.8
Jul-Sep	1.78	142.19	1.25	175.3
Oct-Dec	0.13	183.29	-1.17	218.36

Table 3: Constants relating historic electrical demand to average outdoor temperature at 1775 and 1765 Weston Road

Season	1775 Weston		1765 Weston	
	m	B	m	B
	(kw/deg)	(kw)	(kw/deg)	(kw)
Jan-Mar	1.51	323.64	-1.73	355.94
Apr-Jun	-2.04	300.96	-1.92	348.61
Jul-Sep	1.30	252.97	-7.70	450.97
Oct-Dec	-2.00	309.23	-0.81	363.35

D. SPACE HEATING

1. Introduction

It was apparent from the beginning that reducing the cost of heating at 1765 Weston Road meant reducing the volume of the air exhausted from the building and reducing the temperature of the exhaust air during the heating season.

Prior to the installation of the new controls the heating in each suite was controlled jointly by the thermostats under tenant control and the temperature of the space heating water which was set by an indoor/outdoor controller. This indoor/outdoor controller generated heated water according to the outdoor temperature with no reference to the temperature of the building. The temperature of the intake air to the corridors was controlled by a thermostat. This control arrangement has the following drawbacks:

1. The space heating water must be hot enough to keep the building adequately warm under any environmental conditions that may accompany the present outdoor temperature. Under mild conditions a tenant could have his thermostat set high and windows open to reduce the temperature rather than control the temperature by the

thermostat.

2. It may be preferable to the tenant to open windows rather than use the thermostat particularly if the air supply is excessively hot.

3. A faulty controller can be worse than no controller at all if management is not aware that it is malfunctioning. A period of inadequate heating would cause many tenants to set their thermostats as high as possible. The costs in energy wasted during a subsequent period of overheating can be very high. This appears to have been the case at 1775 Weston Road for at least part of this study.

The existing indoor/outdoor controller was replaced by a new unit under the direction of the Central Station computer. The air preheating system was modified to allow the boilers to be stepped on allowing finer control of the supply air temperature.

2. Control Strategy

The essence of the control strategy is to provide energy at a rate equal to the rate of loss with little or no avoidable wastage. To this end the following assumptions have been made.

1. Enough heat must be available to maintain all suites at or above the legal minimum temperature when the windows are closed. An exhaust temperature of 23.0 C should normally satisfy this condition.

2. Substantial energy savings can be achieved by having the tenants keep the windows shut during the heating season (September 15 to May 31).

3. The building should not be so warm as to cause tenants to open windows for greater comfort during the heating season. The exhaust temperature should not exceed 24.0 C during the heating season.

4. The tenant should be able to raise (not merely maintain) the temperature of a cool suite in the morning. Otherwise those tenants who set back their thermostats at night would be discouraged from doing so.

5. Control of the space heating water temperature on the basis of the outside air temperature, the exhaust air temperature and the time of day is the best means of achieving the above.

This system controls the space heating by setting an upper limit on the rate that heat can be taken from it. The tenants control the suite temperature with the thermostat. The rate of heat delivery, when the thermostat is calling for more heat, is limited by the temperature of the space heating water. By reducing the

temperature of the space heating water during mild weather and when the building is already warm, one effectively limits the amount of heat that can be withdrawn by any single suite, even if the thermostat is set at its upper limit and the windows are wide open. However, should conditions exist which cause the average temperature of the entire building, and therefore the exhaust air, to drop (e.g. a high wind chill) then the temperature of the space heating water will be raised until the building returns to its satisfied condition.

The set point of the space heating water is a function of the outdoor temperature, the exhaust air temperature and the time of day. A drop in outside air or exhaust air temperature causes an increase in the heating water set point. During the early morning the set point is increased to allow cold suites to warm up.

The controls of the two boilers that provided the heat for the intake air were separated to allow the boilers to be stepped on and off and thereby provide less fluctuations in the supply air temperature. The set point was made a function of the outdoor air temperature so that the boilers would not come on in mild weather.

3. Indoor/Outdoor Control

a) Theory of Operation:

The central station computer selects one of a number of space heating software modules according to the time of day. Each space heating software module has two lookup tables, one relating the building exhaust temperature to an offset value which will be added to the outdoor temperature to give the adjusted outdoor temperature. The second lookup table relates the adjusted outdoor temperature to the space heating water temperature set point. The computer reads the outdoor air temperature and the exhaust air temperature and calculates the adjusted outdoor air temperature and uses the lookup table to get the corresponding space heating water temperature.

T(adjusted) = T (outdoor) + offset

In this case the effect of raising the adjusted outdoor temperature is to reduce the space heating water temperature set point.

b) Control by time:

Control of the space heating by the time of day was implemented on December 6, 1982 by adding a second heating

software module, the "warm" module being in effect from 6:00 a.m. to 9:30 a.m., the "cool" module being in effect for the remainder of the day. The "warm" module allows more heat in the early morning when people are getting up and suite temperatures may have to be raised. The "cool" module allows sufficient heat to maintain the suites at any reasonable temperature, but not enough to raise the temperature as rapidly as a tenant may wish. The two modules differ in their tables of offsets, the values being higher for the cool period than for the warm period. In effect, given the same outside air temperature and exhaust air temperature the space heating water is hotter in the morning than during the rest of the day. Details of the offset values in effect at a given time are provided in Table 4 on Page 15.

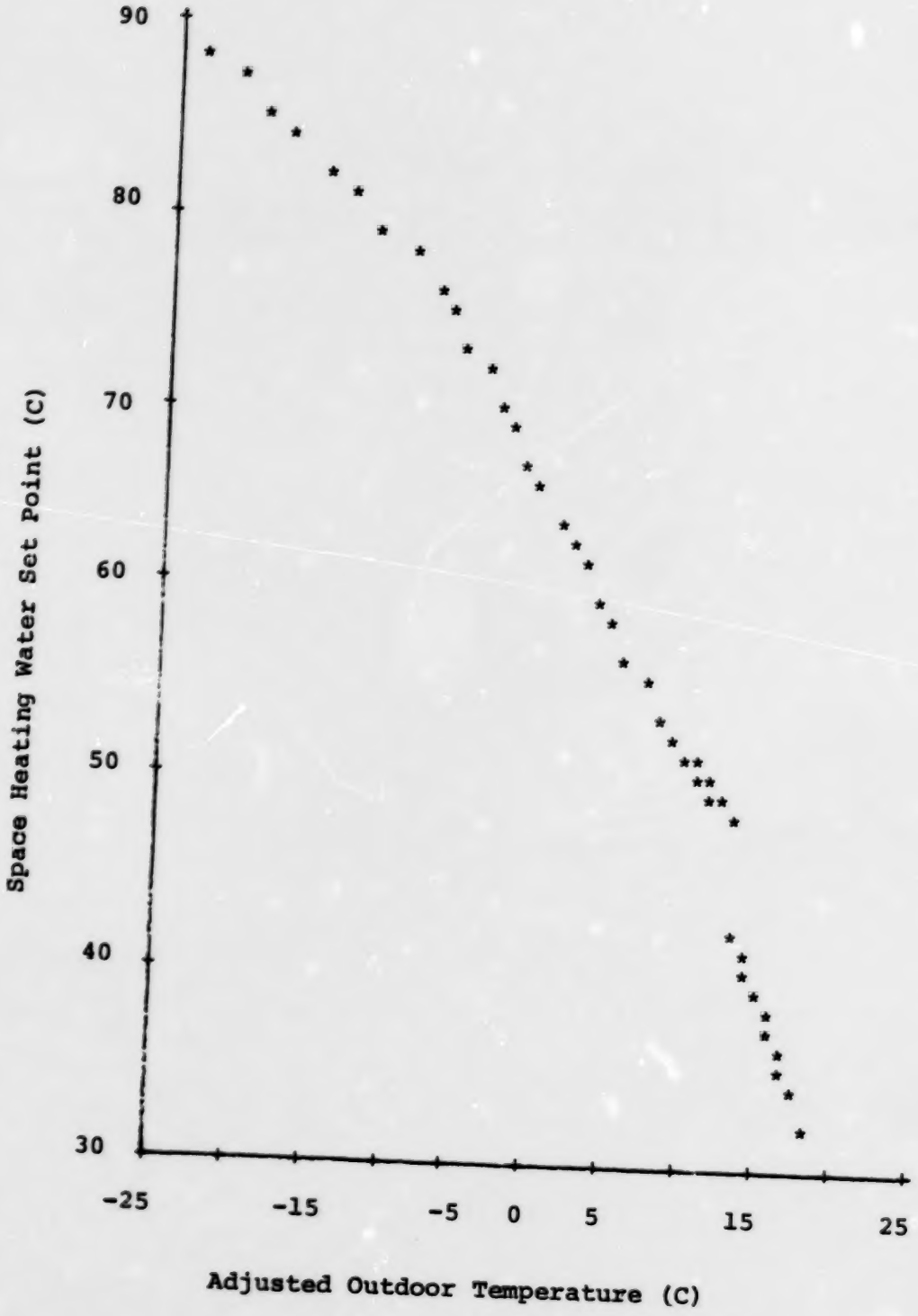
c) Control by outdoor air temperature:

The outdoor air temperature is one of the two components of the adjusted outdoor air temperature that determines the set point for the space heating water. The decimal equivalent of the lookup table that controlled the space heating water temperature set point is shown in Figure 1 on Page 16.

TABLE 4: Offsets Added to Outdoor Temperature to Get Adjusted Outdoor Temperature

Exhaust Air Temp (C)	Offset (C)			
	Oct 5/81 to Apr 29/82	Apr 29/82 to Dec 6/82	Dec 6/82 - Apr 19/83	
			"warm" period	"cool" period
21.5	-8.5	-8.5	-8.5	-8.5
22.0	-8.5	-8.5	-8.5	-5.5
22.5	-7.5	-5.5	-5.5	-4.0
23.0	-6.5	-4.0	-4.0	0
23.5	-4.0	0	0	+2.0
24.0	-1.0	+2.0	+1.0	+4.0
24.5	0	+4.0	+2.0	+6.5

Figure 1. Relationship between Space Heating Water Set Point and Adjusted Outdoor Temperatures



d) Control by exhaust air temperature:

The ability of the heating system to respond to a change in the exhaust air temperature is critical to effective energy conservation. An indoor-outdoor controller which has only the outside air temperature as input is adjusted to provide adequate heat during high winds and will provide more than enough heat under mild conditions. To the tenant faced with the choice of controlling his environment by adjusting the thermostat or by opening windows the additional ventilation can make the use of the windows the preferred option. If the building heating is reduced (but not altogether eliminated) when the building is warm opening the windows will cool the suite and thereby require the tenant to shut the windows before comfortable conditions can be achieved.

It is essential also that the temperature of the air supply to the suites be controlled to prevent overheating. When the windows are closed, the air supply is drawn from the corridors. The boilers preheating the corridor air represent more than twenty percent of the total space heating capacity of the building. If the supply air set point is too high, the air preheaters may

provide so much heat that the spillage into tenants' suites will entice them to open the windows for comfort.

The building exhaust air temperature represents the average temperature of the suite exhaust and is therefore a reasonable measure of the temperature of the suites as a whole. It determines the offset to the outdoor temperature and is critical to successful energy conservation. If the building temperature drops, the offset drops (it may be negative) and the adjusted oudoor temperature drops, causing a rise in the space heating water temperature. When the exhaust air temperature rises, again the offset rises and the adjusted outdoor temperature rises causing the set point of the space heating water temperature to drop. To be effective in reducing the heating system output, when the building is warm, the offset to the outdoor temperature should change at a rate of approximately 8 degrees per degree change in exhaust air. If a prolonged failure of the heating system makes a building uncomfortably cold, the offset would decrease causing the adjusted outdoor temperature to drop, thereby increasing the set point of the space heating water far beyond its normal value for operating at that outdoor temperature. As the building temperature recovered, the increasing exhaust air temperature would raise the offset and lower the set point of the space heating water temperature to bring the building to a steady state.

E. VENTILATION

1. Introduction

Building ventilation can be divided into three parts; the mechanical ventilation via supply and exhaust fans which may be controlled by management, suite window ventilation which is controlled by the tenant, and other natural building ventilation which is not readily controlled by anyone. Ideally the total ventilation would be adequate at all times to provide a safe and pleasant atmosphere within the building with a minimum expenditure of energy for heating or cooling.

In a large residential building excessive ventilation during the heating season represents a large part of energy bills. Natural building ventilation increases as the outdoor temperature drops and the difference between the building temperature and the outdoor air temperature increases. In very cold weather the "chimney effect" can keep a building adequately ventilated even with the windows closed and the mechanical ventilation substantially reduced.

Substantial savings can be achieved by inducing the tenants to keep their windows and balcony doors closed during the heating season. Apart from billing tenants for

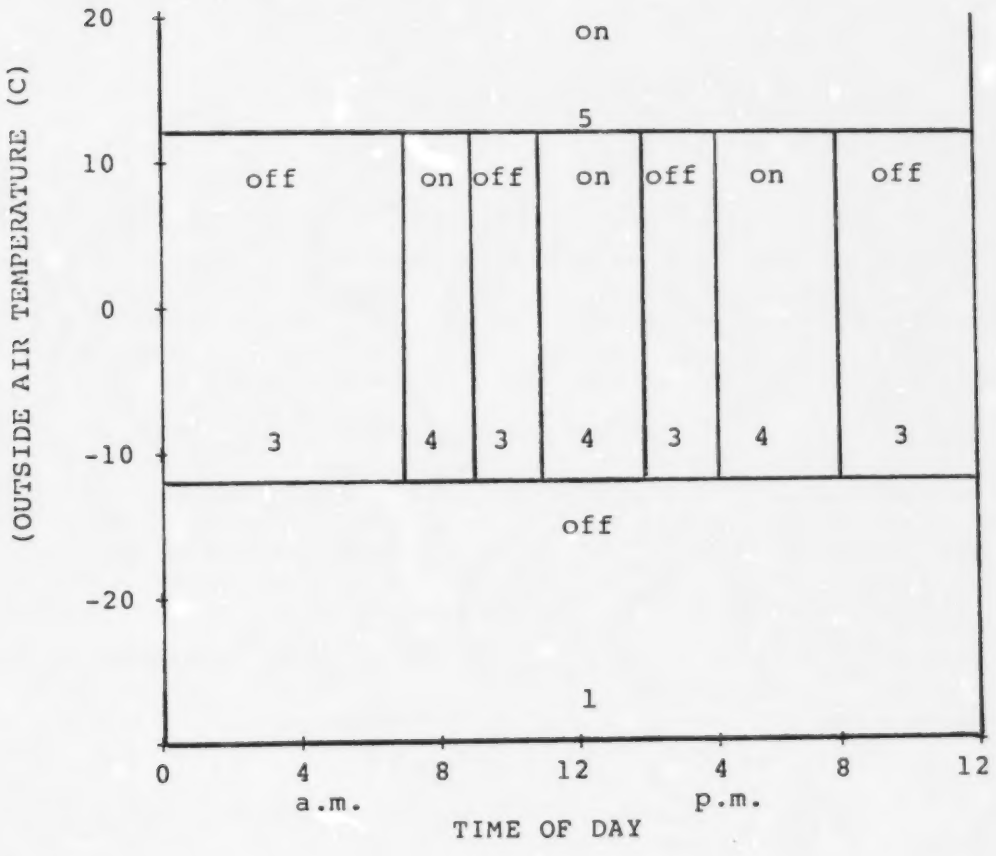
their own use of energy the most effective means of persuading them to keep the windows closed is to provide enough heat to keep the suite warm when the windows are shut, but not enough to maintain a high temperature when the windows are open. There must be adequate mechanical ventilation to prevent odour accumulation, particularly at mealtimes.

2. Fan Control

Energy savings are achieved while maintaining adequate ventilation by cycling exhaust fans according to the time of day and the outdoor temperature. Every area of a building needs some form of mechanical ventilation but much less in cold weather than in hot. Each building has five exhaust fans and a single intake fan. To achieve a uniform reduction in ventilation throughout the demonstration building, the exhaust fans were cycled such that each fan operated in accordance with the same on/off duty cycle as every other fan. However, the fan turn on times were staggered to keep the number of fans on at any instant at the value set by the Central Station computer. This staggering was achieved by turning one fan on and another off at intervals of 15 minutes so that the total number of fans on remained constant. Although fan belts may need replacing more often, the result of cycling

FIGURE 2: FAN CONTROL GRAPH, DEMONSTRATION BUILDING

Each region of the graph is marked with an integer showing the number of exhaust fans set on and the status of the supply fan (on or off) as determined by the Central Station computer for the corresponding outdoor temperature and time of day.



exhaust fans is a better air quality than can be achieved by simply turning off one or more fans for the duration of a cold snap. The operation of the fans at 1765 Weston Road was in accordance with the time and temperature schedule shown in Figure 2 on Page 21. Unfortunately, mechanical problems with the fans left one or more inoperative much of the time.

3. Odour Control

It was recognized from the outset that sufficient mechanical ventilation would have to be operating to keep odours to an acceptable minimum. Since kitchen odours are associated primarily with mealtimes and bathroom odours are unwelcome anytime, there must be some mechanical ventilation at all times with more for mealtimes. The cycling scheme shown in Figure 2 meets this requirement. In addition, by having the supply fan on at meal times the flow of air from corridor to suite confines odours to the suite of origin.

F. RESULTS

Weekly readings of the gas and hydro consumption, as monitored by pulse counters in each building, are presented in Appendix C. The inclusion of the gas consumption for the recreation facility in the 1775 Weston Road figures, and the hydro consumption for that facility in the 1765 Weston Road figures limits the usefulness of direct comparisons.

Analysis of the monthly gas and hydro bills are included in Appendices D and E respectively. These analyses relate the current consumption at each building to the historical performance of that building.

1) Gas

Gas savings in the demonstration building, when compared to its own history, were disappointingly low until the beginning of the 1982-83 heating season. In April 1982 the offsets due to high exhaust air temperatures were raised (Table 4). The second space heating module was introduced in December 1982. The offsets in effect during the "cool" period were then raised substantially, while those in the much shorter "warm" period were reduced. The value of the gas savings increased dramatically from $1608 in November to $3495 in

December. Exceptionally mild weather in December, January and February allowed the heating system to operate far below its capacity. During the same period, the control building 1775 Weston Road increased its gas consumption relative to its own history.

The gas savings at 1765 Weston Road for the year ending March 13, 1983 were 2518 MCF, based on a comparison with the history of that building, or 3813 MCF based on a comparison with 1775 Weston Road, the control building.

The summer period gas consumption in both buildings increased substantially in 1981 prior to the introduction of the new controls. The same high consumption was seen in 1982 when 1765 Weston Road was controlled by ADMIC. No satisfactory explanation has been found.

Comparisons between gas consumption as recorded by the pulse counters (Appendix C) at 1765 Weston Road and 1775 Weston Road show greatest savings (1430 cubic meters/day) between April 10, 1982 and April 16, 1982. Failure of the pulse generating equipment at 1765 Weston Road made further comparisons in March invalid. The savings were not entirely due to improvements at 1765 Weston but to the erratic performance of the controller at 1775 Weston, which maintained the space heating water at essentially

the same temperature at 0 C weather as it did at -20 C.

2. Electricity

The major thrust of this project has been to achieve energy savings through better control of the space heating system. No attempt was made to influence tenants in their use of electricity. A slight increase in electrical consumption was expected as tenants who insisted on maintaining their suites at temperatures far higher than the legal minimum augmented the heating system with portable electric units or by turning on their stoves. Electrical consumption and demand at 1765 Weston Road were unusually high in January 1982 due to failure of the heating system in exceptionally cold weather when a pipe ruptured and left the entire building without heat for several hours. Comparisons with 1775 Weston Rd are made difficult by the additional load of the recreation center on the 1765 Weston Road hydro metering. However, when compared to its own history, 1775 Weston Road had electricity consumption losses twice as great as those at 1765 Weston Road.

Table 5

Summary of electricity savings (losses) for April 1982 - March 1983 based on the history of each building

	Demo	Control
Building	1765	1775
Energy saved (kwh)	(62730)	(79471)
Demand saved (kw)	(93)	(127)
Total consumption (kwh)	1888400	1656800
Total demand (kw)	4106	2912

3) Cost/Benefit Analysis

The year ending March 13, 1983 was selected for evaluating the results of this program. During that time the value of the savings at 1765 Weston Road based on a comparison with its own history were:

Natural gas	$12079.54
Hydro consumption	-2257.67
Hydro demand	-208.49
Total savings for 1 year	$ 9613.38

When compared on an ongoing basis with 1775 Weston Road after correction for the recreation center the savings were:

Natural gas	3813 mcf	$ 16853.46
Hydro consumption	-8252 kwh	-226.93
Hydro demand	33 kw	85.80
Total savings for 1 year		$ 16712.33

The costs of this project have been divided into those that would be incurred in the operation of any similar building, and those that are due to the experimental nature of this project (extra metering, report writing).

Experimental costs	$33919
Engineering, equipment, installation and system balancing:	29057
Monitoring and phone lines	5664
Total cost of project for one year	$68640

The costs above provided for control and monitoring of one building and monitoring of an adjacent building. The typical monthly operating costs of a single building of this type are:

Control and monitoring	$ 250.00
Telephone	150.00
Maintenance	150.00
Tax (7%)	38.50
Total for 1 month	$ 588.50
Total for 1 year	$ 7062.00

The payback period based on the comparison of the two buildings and an installation cost of $15000 for a single building is 1.6 years.

G. DISCUSSION

A slight increase in electricity consumption was expected as some tenants supplemented their suite heating with portable electric units. The increase relative to 1775 Weston Road was 8252 KWH, less than 2% of the total, with a cost of $227. The value of the gas savings is so much greater that it is well worth boosting the heat of marginal suites with electric heaters rather than operating the entire building at a level that is adequate for a few suites and excessive for most.

The difference between the results of the two methods of calculating energy savings reflects the deterioration in the operation of the control building (1775 Weston Road) particularly in its indoor/outdoor controller.

The critical factor in achieving substantial savings has been the reduction of the temperature of the space heating water when the building exhaust temperature is high. The summer season losses, when the heating was not on, indicate problems in the domestic hot water systems of both buildings; losses which would continue through the heating season but were small compared to the savings achieved by more efficient operation of the heating system. The increased gas savings in the heating months

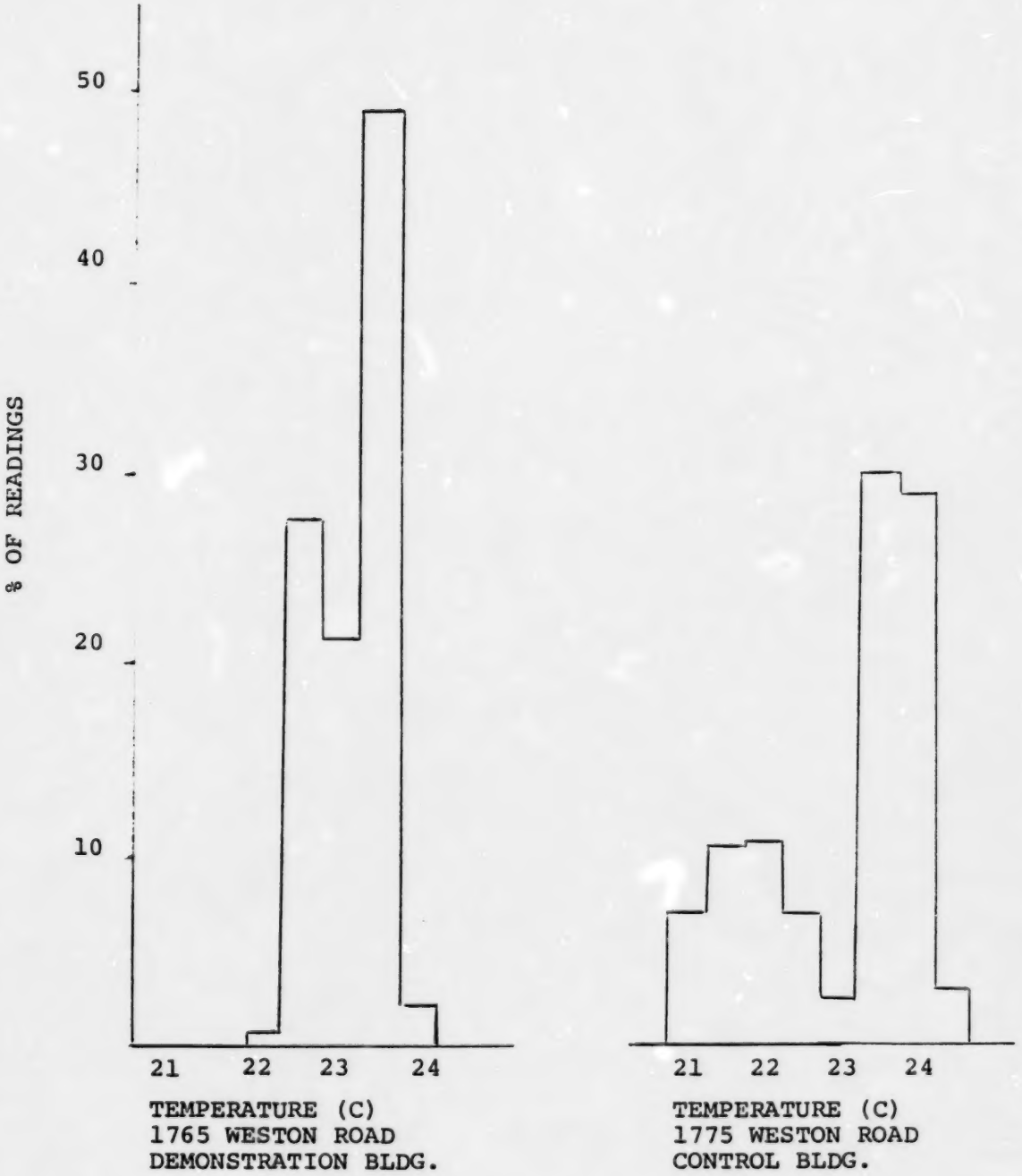
following the increases in the offsets shows that when excess heat has been available it has been wasted. Apart from saving energy, reducing the temperature of the space heating water when the building is warm and increasing it when the building is cool, has reduced the variation in exhaust temperature.

Figure 3 shows a comparison of the distribution of exhaust air temperatures as observed for the two buildings during a part of the heating season when the demonstration building was achieving savings as great as 15% of the consumption. The temperature extremes experienced in the demonstration building fell between the extremes found in the control building showing that the suite temperatures were more uniform through time. The lack of savings at 1775 Weston Road during the same period show that it is more efficient to keep the building at a constant temperature than to allow significant day-to-day fluctuation. In extremely cold weather both buildings would have to operate at the maximum output of their heating systems and the consumption of gas would be equal in the two buildings.

The small but consistent gas losses at the demonstration building during the summer months indicate a problem in the domestic hot water system. The losses at

1775 Weston Road reflect a general problem with control systems within that building.

Figure 3. DISTRIBUTION OF EXHAUST AIR TEMPERATURES from Jan. 18 - Jan. 28, 1983 showing the narrower range at 1765 Weston Road achieved by making the space heating water temperature setpoint a function of the exhaust air temperature as well as the outdoor air temperature. The Control Building experienced both underheating and overheating during the same period.



APPENDIX A

Monthly average temperatures and gas consumption for 1765 Weston Road and 1775 Weston Road prior to the implementation of new controls.

1765 Weston Road	Jan. 1977 - Sept. 1981
1775 Weston Road	Jan. 1976 - Dec. 1977
	Jan. 1979 - Sept. 1981

PAGE TWO NATURAL GAS BILLS: HISTORIC SUMMARY

LOCATION 1765 WESTON ROAD, TORONTO

	YEAR: 1976/77			YEAR: 1977/78			YEAR: 1978/79		
		DAILY AVER CONS			DAILY AVER CONS			DAILY AVER CONS	
MONTH	AVER TEMP	MCF	M**3	AVER TEMP DEG C	MCF	M**3	AVER TEMP DEG C	MCF	M**3
JUNE									
JULY				19.33	12.18	345	19.44	11.18	317
AUG				22.60	9.96	282	21.42	8.35	237
SEPT				20.50	9.67	274	20.91	8.53	241
OCT				15.67	13.36	378	15.11	15.39	436
NOV				10.74	46.69	1322	9.59	47.09	1334
DEC				3.65	84.15	2383	3.02	83.63	2368
JAN	-4.82	116.39	3296	-3.10	113.36	3210	-1.55	109.25	3094
FEB	-9.01	132.41	3749	-7.23	121.52	3441	-6.40	127.09	3599
MAR	-1.49	108.80	3081	-6.50	112.73	3192	-6.71	125.94	3566
APR	4.93	69.10	1957	0.20	82.89	2347	3.02	77.46	2193
MAY	9.78	47.31	1340	6.39	55.65	1576	6.81	63.24	1791
JUNE	17.40	23.56	667	16.38	20.69	586	14.05	23.64	669

PAGE TWO NATURAL GAS BILLS: HISTORIC SUMMARY

LOCATION 1765 WESTON ROAD. TORONTO

	YEAR:1979/80			YEAR: 1980/81			YEAR:1981/82		
	AVER TEMP	DAILY AVER CONS		AVER TEMP	DAILY AVER CONS		AVER TEMP	DAILY AVER CONS	
MONTH	DEG C	MCF	M**3	DEG C	MCF	M**3	DEG C	MCF	M**3
JUNE									
JULY	18.2	12.40	351	17.3	10.84	307	20.81	13.45	381
AUG	22.24	9.67	274	23.08	9.01	255	21.78	14.06	398
SEPT	19.35	8.15	231	22.14	9.44	267	20.45	11.07	314
OCT	15.78	15.09	427	14.74	29.81	844			
NOV	8.51	53.83	1524	7.21	55.58	1574			
DEC	4.15	74.55	2111	2.33	80.24	2272			
JAN	-.12	92.12	2608	-6.38	122.54	3470			
FEB	-4.66	112.24	3178	-6.36	120.37	3408			
MAR	-5.49	112.90	3197	1.34	102.63	2906			
APR	1.3	85.04	2408	4.24	81.04	2295			
MAY	9.34	49.52	1402	8.44	55.14	1561			
JUNE	15.15	27.56	780	15.21	29.54	836			

PAGE TWO NATURAL GAS BILLS: HISTORIC SUMMARY

LOCATION 1775 WESTON ROAD, TORONTO

	YEAR: 1976/77			YEAR: 1977/78			YEAR: 1978/79		
		DAILY AVER CONS			DAILY AVER CONS			DAILY AVER CONS	
MONTH	AVER TEMP	MCF	M**3	AVER TEMP DEG C	MCF	M**3	AVER TEMP DEG C	MCF	M**3
JUNE									
JULY	21.38	15.00	425	19.53	16.10	456			
AUG	20.25	15.80	447	22.6	14.24	403			
SEPT	20.56	15.45	437	20.5	13.51	383			
OCT	16.05	24.61	697	15.67	18.23	516			
NOV	6.41	75.45	2136	10.74	44.57	1262			
DEC	-.14	111.37	3154	3.65	104.61	2962			
JAN	-4.82	125.99	3568				-1.55	122.88	3480
FEB	-9.01	131.57	3726				-6.4	132.01	3738
MAR	-1.49	103.30	2925				-6.71	133.75	3787
APR	4.93	70.45	1995				3.02	87.81	2487
MAY	9.78	66.25	1876				6.81	70.98	2010
JUNE	17.4	2.42	69				14.05	39.66	1123

PAGE TWO NATURAL GAS BILLS: HISTORIC SUMMARY

LOCATION 1775 WESTON ROAD, TORONTO

	YEAR: 1979/80			YEAR: 1980/81			YEAR: 1981/82		
	AVER	DAILY AVER CONS		AVER	DAILY AVER CONS		AVER	DAILY AVER CONS	
MONTH	TEMP	MCF	M**3	TEMP DEG C	MCF	M**3	TEMP DEG C	MCF	M**3
JUNE									
JULY	18.2	23.24	658	17.3	18.15	514	20.81	23.19	657
AUG	22.24	11.54	327	23.08	15.05	426	21.78	21.44	607
SEPT	19.35	12.46	353	22.14	14.91	422	20.45	19.70	558
OCT	15.78	22.01	623	14.74	35.28	999			
NOV	8.51	57.03	1615	7.21	73.71	2087			
DEC	4.15	88.48	2506	2.33	100.22	2838			
JAN	-.12	107.12	3033	-6.38	135.25	3830			
FEB	-4.66	126.16	3573	-5.56	126.12	3571			
MAR	-5.49	123.30	3491	2.38	107.06	3032			
APR	1.3	95.11	2693	4.24	87.08	2466			
MAY	9.34	69.53	1969	8.44	67.32	1906			
JUNE	15.15	39.43	1116	15.21	37.02	1048			

APPENDIX B

Monthly average temperatures and electricity consumption for 1765 Weston Road and 1775 Weston Road prior to the implementation of new controls.

1765 Weston Road Jan. 1977 - Sept. 1981

1775 Weston Road June 1979 - Sept. 1981

HISTORICAL DATA SUMMARY

LOCATION: 1765 WESTON ROAD, WESTON

	YEAR: 1977/78			YEAR: 1978/79			YEAR: 1979/80		
MONTH	AVER TEMP	AVER POWER	PEAK DEMAND	AVER TEMP	AVER POWER	PEAK DEMAND	AVER TEMP	AVER POWER	PEAK DEMAND
JUNE									
JULY				21.48	199	318	21.52	202	336
AUG				21.02	200	140	19.97	199	312
SEPT				16.63	194	332	16.73	196	312
OCT				10.22	203	348	10.19	202	360
NOV				4.86	217	404	5.69	207	352
DEC				-1.04	224	376	.16	219	352
JAN	-6.42	242	370	-5.44	222	391	-3.41	222	370
FEB	-6.90	218	360	-8.74	220	368	-5.90	218	356
MAR	-1.77	234	344	2.66	256	376	-0.60	220	328
APR	5.65	201	352	6.69	151	328	7.62	206	324
MAY	13.92	197	344	12.53	199	320	15.21	194	296
JUNE	18.61	194	344	18.24	196	300	16.28	199	296

HISTORICAL DATA SUMMARY

LOCATION: 1765 WESTON ROAD, WESTON

	YEAR: 1980/81			YEAR: 1981/82		
MONTH	AVER TEMP	AVER POWER	PEAK DEMAND	AVER TEMP	AVER POWER	PEAK DEMAND
JUNE						
JULY	21.94	210	300			
AUG	22.44	201	300			
SEPT	17.37	203	304	16.26	194	352
OCT	8.87	194	332			
NOV	3.73	214	366			
DEC	-2.92	217	348			
JAN	-7.42	233	376			
FEB	-1.47	220	360			
MAR	1.65	199	348			
APR	8.52	220	328			
MAY	13.16	190	308			
JUNE	18.64	193	310			

HISTORICAL DATA SUMMARY

LOCATION: 1775 WESTON ROAD, WESTON

	YEAR: 1979/80			YEAR: 1980/81			YEAR: 1981/82		
MONTH	AVER TEMP	AVER POWER	PEAK DEMAND	AVER TEMP	AVER POWER	PEAK DEMAND	AVER TEMP	AVER POWER	PEAK DEMAND
JUNE									
JULY	21.52	187	292	21.94	177	280	0	0	0
AUG	19.97	183	272	22.44	178	280	0	0	0
SEPT	16.73	179	280	17.37	167	264	16.26	167	280
OCT	10.19	187	288	8.87	177	292			
NOV	5.69	184	300	3.73	190	304			
DEC	.16	188	300	-2.92	177	320			
JAN	-3.41	194	316	-7.42	200	324			
FEB	-5.9	190	300	-1.47	196	344			
MAR	-.6	183	300	1.65	172	332			
APR	7.62	178	284	8.52	194	288			
MAY	15.21	172	264	13.16	167	264			
JUNE	16.28	172	288	18.64	161	256			

APPENDIX C

Data From Pulse Counters

Weekly readings of cumulative consumption of gas and electricity after installation of the new controls.

RAW DATA FROM PULSE COUNTERS AT 1765 AND 1775 WESTON ROAD
WEEKLY READINGS OF CUMULATIVE GAS AND HYDRO CONSUMPTION

DATE	1765 HYDRO (KWH)	1775 HYDRO (KWH)	1765 GAS (SCF)	1775 GAS (SCF)
82/2/19	86569.6	62897.2	1912900	2693700
82/2/26	124604.0	94988.8	2607100	3745800
82/3/5	162932.8	128209.6	3405400	4972700
82/3/12	201851.6	161513.6	4100400	6171800
82/3/19	239430.0	193330.4	4132700	7102600
82/3/26	277082.4	225287.6	4132800	7849100
82/4/2	314502.4	257312.4	4313300	8692600
82/4/9	352120.4	289373.6	4965900	9636800
82/4/16	388682.4	319564.8	5470500	10495000
82/4/23	424464.8	350036.0	5894600	10987600
82/4/30	460512.0	38058.8	6160200	11432000
82/5/7	6984.8	5836.0	20500	72600
82/5/28	1958.8	1638.8	5500	9500
82/6/4	37083.2	30484.4	101900	183300
82/6/11	72422.0	59450.4	190900	352400
82/6/18	106693.2	87500.8	275300	490100
82/6/25	140355.6	115088.4	362600	631700
82/7/2	173087.6	143637.2	452000	790500
82/7/9	206168.0	172470.8	540500	922900
82/7/16	31876.4	203726.0	628000	1065800
82/7/23	68658.4	236377.2	710200	1208200
82/7/30	102482.4	266666.8	792100	1356000
82/8/6	135956.8	296444.4	868400	1499200
82/8/13	170439.6	326720.4	944700	1641200
82/8/19	202615.6	354823.6	1027900	1794200
82/8/27	446990.4	386046.8	1122100	1971300
82/9/3	480073.6	416262.0	1215400	2151800
82/9/10	512200.4	445662.0	1308000	2296700
82/9/17	546173.6	476544.0	1396800	2433500
82/9/24	579862.8	507398.4	1513600	2584100
82/10/1	825974.0	540010.4	1680700	2793300
82/10/8	441502.4	571112.0	1830700	2958500
82/10/14	476496.0	602644.0	2023900	3174600
82/10/22	512198.8	636285.2	2313500	3591700
82/10/29	547116.8	669072.0	2592700	3985400
82/11/5	791948.4	701839.2	2798100	4283700
82/11/12	13881.6	735261.6	3179900	4775500
82/11/19	50917.2	769166.8	3594600	5354400
82/11/26	87660.0	802312.0	3949300	5875500
82/12/3	125179.2	835949.6	4355600	6442700
82/12/10	162246.4	868788.4	4764300	6455600
82/12/17	200990.8	903148.0	5297300	6857100
82/12/24	239401.6	937950.0	5856500	7461800
82/12/31	275982.8	971487.2	6266800	8046000
83/1/7	315813.6	1006595.2	6822400	8820800
83/1/14	352368.8	1038102.8	7353300	9533700
83/1/21	393592.8	1076152.8	8173200	10461000
83/1/28	425967.6	1104546.0	8673600	11125800
83/2/4	470068.8	1142831.2	9294500	11987800
83/2/11	509273.6	1177328.0	10011100	12850200
83/2/18	548195.6	1211679.6	10604700	13640200
83/2/25	586910.0	1245680.0	11131200	14372600
83/3/4	624025.2	1278510.4	11652100	15088600
83/3/11	662419.6	1312338.4	12091100	15679500

NATURAL GAS USE AT 1775 WESTON ROAD
VALUES DERIVED FROM WEEKLY READINGS OF A PULSE COUNTER

DATE Y M D	CUM CONS (SCF)	WEEKLY CONS (SCF)	DAILY AVERAGE CONSUMPTION (MCF)	(CUBIC MET)
82/2/19	2693700	1151200	164.4	4656.9
82/2/26	3745800	1052100	150.3	4256.0
82/3/5	4972700	1226900	175.2	4963.1
82/3/12	6171800	1199100	171.3	4850.7
82/3/19	7102600	930800	132.9	3765.3
82/3/26	7849100	746500	106.6	3019.8
82/4/2	8692600	843500	120.5	3412.1
82/4/9	9636800	944200	134.8	3819.5
82/4/16	10495000	858200	122.6	3471.6
82/4/23	10987600	492600	70.3	1992.7
82/4/30	11432000	444400	63.4	1797.7
82/6/4	183300	173800	24.7	700.6
82/6/11	352400	169100	24.0	681.1
82/6/18	490100	137700	19.6	557.7
82/6/25	631700	141600	20.2	572.6
82/7/2	790500	158800	22.7	642.9
82/7/9	922900	132400	18.9	535.8
82/7/16	1065800	142900	20.4	578.7
82/7/23	1208200	142400	20.3	575.4
82/7/30	1356000	147800	21.1	598.3
82/8/6	1499200	143200	20.5	581.7
82/8/13	1641200	142000	20.1	570.4
82/8/19	1794200	153000	24.4	691.0
82/8/27	1971300	177100	22.8	648.4
82/9/3	2151800	180500	25.7	729.0
82/9/10	2296700	144900	20.8	589.6
82/9/17	2433500	136800	19.5	552.2
82/9/24	2584100	150600	21.5	611.2
82/10/1	2793300	209200	29.6	840.4
82/10/14	3174600	216100	34.0	964.0
82/10/22	3591700	417100	54.4	1540.7
82/10/29	3985400	393700	55.9	1585.2
82/11/5	4283700	298300	42.8	1213.3
82/11/12	4775500	491800	70.3	1993.4
82/11/19	5354400	578900	82.3	2331.4
82/11/26	5875500	521100	74.8	2118.5
82/12/3	6442700	567200	80.5	2280.0
82/12/10	6455600	12900	1.8	52.4
82/12/17	6857100	401500	57.2	1621.1
82/12/24	7461800	604700	85.9	2432.6
82/12/31	8046000	584200	83.6	2370.0
83/1/7	8820800	774800	108.2	3065.5
83/1/14	9533700	712900	104.7	2965.3
83/1/21	10461000	927300	129.2	3659.7
83/1/28	11125800	664800	96.4	2731.3
83/2/4	11987800	862000	123.7	3503.7
83/2/11	12850200	862400	123.7	3502.9
83/2/18	13640200	790000	112.6	3189.1
83/2/25	14372600	732400	104.5	2961.0
83/3/4	15088600	716000	102.7	2908.5
83/3/11	15679500	590900	84.0	2379.5

NATURAL GAS USE AT 1765 WESTON ROAD
VALUES DERIVED FROM WEEKLY READINGS OF A PULSE COUNTER

DATE Y M D	CUM CONS (SCF)	WEEKLY CONS (SCF)	DAILY AVERAGE CONSUMPTION (MCF)	(CUBIC MET)
82/2/19	1912900	754800	107.8	3053.3
82/2/26	2607100	694200	99.1	2808.2
82/3/5	3405400	798300	114.0	3229.3
82/3/12	4100400	695000	99.2	2811.4
82/3/19	4132700	32300	4.6	130.6
82/3/26	4132800	100	0.0	.4
82/4/2	4313300	180500	25.7	730.1
82/4/9	4965900	652600	93.2	2639.9
82/4/16	5470500	504600	72.0	2041.2
82/4/23	5894600	424100	60.5	1715.6
82/4/30	6160200	265600	37.9	1074.4
82/6/4	101900	96400	13.7	388.6
82/6/11	190900	89000	12.6	358.5
82/6/18	275300	84400	12.0	341.8
82/6/25	362600	87300	12.4	353.0
82/7/2	452000	89400	12.7	361.9
82/7/9	540500	88500	12.6	358.1
82/7/16	628000	87500	12.5	354.3
82/7/23	710200	82200	11.7	332.1
82/7/30	792100	81900	11.7	331.5
82/8/6	868400	76300	10.9	309.9
82/8/13	944700	76300	10.8	306.4
82/8/19	1027900	83200	13.2	375.7
82/8/27	1122100	94200	12.1	344.8
82/9/3	1215400	93300	13.3	376.8
82/9/10	1308000	92600	13.3	376.8
82/9/17	1396800	88800	12.6	358.5
82/9/24	1513600	116800	16.7	474.0
82/10/1	1680700	167100	23.7	671.3
82/10/14	2023900	193200	30.4	861.9
82/10/22	2313500	289600	37.7	1069.7
82/10/29	2592700	279200	39.7	1124.2
82/11/5	2798100	205400	29.5	835.4
82/11/12	3179900	381800	54.6	1547.5
82/11/19	3594600	414700	58.9	1670.1
82/11/26	3949300	354700	50.9	1442.0
82/12/3	4355600	406300	57.6	1633.2
82/12/10	4764300	408700	58.7	1662.8
82/12/17	5297300	533000	75.9	2152.0
82/12/24	5856500	559200	79.4	2249.6
82/12/31	6266800	410300	58.7	1664.5
83/1/7	6822400	555600	77.6	2198.2
83/1/14	7353300	530900	77.9	2208.3
83/1/21	8173200	819900	114.2	3235.8
83/1/28	8673600	500400	72.6	2055.8
83/2/4	9294500	620900	89.1	2523.7
83/2/11	10011100	716600	102.7	2910.6
83/2/18	10604700	593600	84.6	2396.2
83/2/25	11131200	526500	75.1	2128.5
83/3/4	11652100	520900	74.7	2116.0
83/3/11	12091100	439000	62.4	1767.8

A COMPARISON OF RATES OF GAS CONSUMPTION AT 1765 AND 1775 WESTON ROAD

DAILY AVERAGE CONSUMPTION FIGURES FOR THE WEEK PRECEDING THE DATE SHOWN

DATE Y M D	1765 CONS (CUB MET)	1775 CONS (CUB MET)	DIFFERENCE (CUB MET)
82/2/19	3053.3	4656.9	1603.6
82/2/26	2808.2	4256.0	1447.8
82/3/5	3229.3	4963.1	1733.8
82/3/12	2811.4	4850.7	2039.3
82/3/19	130.6	3765.3	3634.7
82/3/26	.4	3019.8	3019.4
82/4/2	730.1	3412.1	2682.0
82/4/9	2639.9	3819.5	1179.6
82/4/16	2041.2	3471.6	1430.4
82/4/23	1715.6	1992.7	277.1
82/4/30	1074.4	1797.7	723.3
82/6/4	388.6	700.6	312.0
82/6/11	358.5	681.1	322.6
82/6/18	341.8	557.7	215.9
82/6/25	353.0	572.6	219.6
82/7/2	361.9	642.9	281.0
82/7/9	358.1	535.8	177.7
82/7/16	354.3	578.7	224.4
82/7/23	332.1	575.4	243.3
82/7/30	331.5	598.3	266.8
82/8/6	309.9	581.7	271.8
82/8/13	306.4	570.4	264.0
82/8/19	375.7	691.0	315.3
82/8/27	344.8	648.4	303.6
82/9/3	376.8	729.0	352.2
82/9/10	376.8	589.6	212.8
82/9/17	358.5	552.2	193.7
82/9/24	474.0	611.2	137.2
82/10/1	671.3	840.4	169.1
82/10/14	861.9	964.0	102.1
82/10/22	1069.7	1540.7	471.0
82/10/29	1124.2	1585.2	461.0
82/11/5	835.4	1213.3	377.9
82/11/12	1547.5	1993.4	445.9
82/11/19	1670.1	2331.4	661.3
82/11/26	1442.0	2118.5	676.5
82/12/3	1633.2	2280.0	646.8
82/12/10	1662.8	52.4	-1610.4
82/12/17	2152.0	1621.1	-530.9
82/12/24	2249.6	2432.6	183.0
82/12/31	1664.5	2370.0	705.5
83/1/7	2198.2	3065.5	867.3
83/1/14	2208.3	2965.3	757.0
83/1/21	3235.8	3659.7	423.9
83/1/28	2055.8	2731.3	675.5
83/2/4	2523.7	3503.7	980.0
83/2/11	2910.6	3502.9	592.3
83/2/18	2396.2	3189.1	792.900001
83/2/25	2128.5	2961.0	832.5
83/3/4	2116.0	2908.5	792.5
83/3/11	1767.8	2379.5	611.7

APPENDIX D

Energy Analysis: Gas

1765 Weston Road October 1981 - June 1982

1765 Weston Road July 1982 - May 1983

1775 Weston Road October 1981 - June 1982

1775 Weston Road July 1982 - May 1983

ADMIC CONTROLS

NATURAL GAS REPORT

BUILDING ENERGY PERFORMANCE SUMMARY (GAS) FOR THE PERIOD OCTOBER 1981 TO JUNE 1982

LOCATION: 1765 WESTON ROAD, WESTON

NO. OF SUITES 245

READING DATE		ENERGY CONSUMP.	TOTAL GAS	GAS COST DOLLARS	OUTDOOR AV TEMP	AVERAGE CONSUMP. (MCF/DAY)			ENERGY SAVED (MCF)		COST SAVINGS	
MONTH	DAY	MCF	COSTS	PER MCF	DEG C	PRESENT	HISTORIC	SAVINGS	MONTH	TOTAL	MONTH	CUMULATIVE
JUNE												
JULY												
AUG												
SEPT	4											
OCT	7	1068.4	3988.43	3.73	14.17	32.38	24.56	-7.81	-258	-258	-962.70	-962.70
NOV	4	1546.9	6020.50	3.89	8.21	55.25	55.06	-0.19	-5	-263	-20.38	-983.08
DEC	10	2742	10518.06	3.84	3.54	76.17	78.96	2.79	100	-163	385.26	-597.81
JAN	7	2686.4	10308.83	3.84	-1.89	95.94	107.17	11.23	314	152	1206.49	608.68
FEB	10	4423.8	16847.30	3.81	-9.13	130.11	129.31	-0.80	-27	124	-103.67	505.00
MARCH	10	3180.5	13475.15	4.24	-3.88	113.59	113.26	-0.33	-9	115	-39.44	465.57
APRIL	7	2356.8	10464.55	4.44	1.35	84.17	83.13	-1.04	-29	86	-129.10	336.46
MAY	5	1463	6423.34	4.39	8.75	52.25	53.13	0.88	25	111	108.72	445.18
JUNE	4	464.8	2079.39	4.47	15.33	15.49	26.46	10.97	329	440	1471.84	1917.02

AVERAGE CONSUMPTION IN MCF/DAY (HISTORIC) IS CALCULATED FROM THE "OUTDOOR AV. TEMP" AND THE HISTORIC RELATIONSHIP BETWEEN "AVERAGE CONSUMPTION" AND "OUTDOOR AV TEMP".
"OUTDOOR AV. TEMP" IS THE AVERAGE OUTDOOR TEMPERATURE DURING THE BILLING PERIOD.

ENERGY COST SAVINGS: 1917.02 DOLLARS PER YEAR 2.39 PERCENT OF ENERGY COST

7.82 DOLLARS PER SUITE

BUILDING ENERGY PERFORMANCE SUMMARY (GAS) FOR JULY 1982 TO MAY 1983 ADMIC CONTROLS

LOCATION: 1765 WESTON ROAD, WESTON NO. OF SUITES: 245

******** ENERGY BILL INFORMATION ********** ********** CALCULATED VALUES*********

READING DATE		ENERGY CONSUMP.	TOTAL GAS	COST DOLLARS	OUTDOOR AV TEMP	AVERAGE CONSUMP. (MCF/DAY)			ENERGY SAVED	COST SAVED
MONTH	DAY	MCF	COSTS	PER MCF	DEG C	PRESENT	HISTORIC	SAVINGS	(MCF)	($)
JUNE	4									
JULY	8	427.7	1913.41	4.47	17.7	12.58	11.37	-1.21	-41	-184.24
AUG	5	333.5	1491.91	4.47	22.36	11.91	10.04	-1.87	-52	-234.43
SEPT	9	443.3	1983.21	4.47	17.97	12.67	11.29	-1.37	-48	-215.23
OCT	6	510	2279.55	4.47	15.9	18.89	15.71	-3.18	-86	-383.82
NOV	10	1321.6	5940.61	4.50	9.90	37.76	45.95	8.19	287	1288.63
DEC	8	1573.3	7297.22	4.64	5.57	56.19	68.57	12.38	347	1607.70
JAN	6	2210.5	10806.56	4.89	.17	76.22	100.87	24.65	715	3494.63
FEB	9	3175.7	15521.37	4.89	-2.92	93.40	110.30	16.90	574	2807.56
MARCH	9	2248.7	11048.69	4.91	1.08	80.31	98.10	17.79	498	2447.07
APRIL	7	2193.5	10853.76	4.95	2.09	75.64	80.13	4.50	130	645.04
MAY	5	1447.2	7121.53	4.92	7.98	51.69	56.26	4.57	128	629.69
JUNE									2451	11902.61
TOTALS FOR PERIOD:		15885	76257.82							

AVERAGE CONSUMPTION IN MCF/DAY (HISTORIC) IS CALCULATED FROM "OUTDOOR AV. TEMP" AND THE HISTORIC RELATIONSHIP BETWEEN "AVERAGE CONSUMPTION" AND "OUTDOOR AV TEMP
"OUTDOOR AV. TEMP" IS THE AVERAGE OUTDOOR TEMPERATURE DURING THE BILLING PERIOD

ENERGY COST SAVINGS: $ 11902.61 15.61 % OF COST $ 48.58 PER SUITE

FOR FURTHER INFORMATION CONTACT THE ENERGY BILL ANALYSIS DEPARTMENT OF:
ADMIC CONTROLS, UNIT 2, 33 GLENCAMERON ROAD, THORNHILL, ONTARIO, L3T 1N9 TEL (416) 881 4112

ADMIC CONTROLS NATURAL GAS REPORT

BUILDING ENERGY PERFORMANCE SUMMARY (GAS) FOR THE PERIOD OCT 1981 TO JUNE 1982

LOCATION: 1775 WESTON ROAD, WESTON SIZE(SQ METERS): ? NO. OF SUITES 244

******** ENERGY BILL INFORMATION ********** ********** CALCULATED VALUES **********

READING DATE		ENERGY CONSUMP.	TOTAL GAS	GAS COST DOLLARS	OUTDOOR AV TEMP	AVERAGE CONSUMP. (MCF/DAY)			ENERGY SAVED (MCF)		COST SAVINGS	
MONTH	DAY	MCF	COSTS	PER MCF	DEG C	PRESENT	HISTORIC	SAVINGS	MONTH	TOTAL	MONTH	CUMULATIVE
JUNE												
JULY												
AUG												
SEPT	4											
OCT	7	1688.9	6252.92	3.70	14.17	51.18	31.55	-19.63	-648	-648	-2398.72	-2398.72
NOV	4	2117.7	8168.61	3.86	8.21	75.63	66.15	-9.48	-266	-913	-1024.33	-3423.05
DEC	10	3380.4	12920.66	3.82	3.54	93.90	93.26	-0.64	-23	-936	-87.97	-3511.02
JAN	7	3493.7	13317.00	3.82	-1.89	124.78	116.21	-8.56	-240	-1176	-915.77	-4426.78
FEB	10	4980.9	18943.94	3.80	-9.13	146.50	137.55	-8.95	-304	-1480	-1157.39	-5584.18
MARCH	11	3716.4	15694.08	4.22	-3.62	128.15	121.31	-6.84	-198	-1679	-837.70	-6421.87
APRIL	7	2821.1	12486.98	4.43	1.46	104.49	97.61	-6.87	-186	-1864	-821.21	-7243.09
MAY	5	1942.2	8464.55	4.36	8.75	69.36	62.94	-6.42	-180	-2044	-784.01	-8027.09
JUNE	4	865.8	3826.58	4.42	15.33	28.86	31.64	2.78	83	-1961	368.94	-7658.15

AVERAGE CONSUMPTION IN MCF/DAY (HISTORIC) IS CALCULATED FROM THE "OUTDOOR AV. TEMP" AND THE HISTORIC RELATIONSHIP BETWEEN "AVERAGE CONSUMPTION" AND "OUTDOOR AV TEMP".
"OUTDOOR AV. TEMP" IS THE AVERAGE OUTDOOR TEMPERATURE DURING THE BILLING PERIOD.

ENERGY COST SAVINGS: -7658.15 DOLLARS PER YEAR -7.65 PERCENT OF ENERGY COST

-31.39 DOLLARS PER SUITE

BUILDING ENERGY PERFORMANCE SUMMARY (GAS) FOR JULY 1982 TO JUNE 1983 ADMIC CONTROLS

LOCATION: 1775 WESTON ROAD, WESTON NO. OF SUITES: 244

******** ENERGY BILL INFORMATION ********** ********** CALCULATED VALUES**********

READING DATE		ENERGY CONSUMP.	TOTAL GAS	COST DOLLARS	OUTDOOR AV TEMP	AVERAGE CONSUMP. (MCF/DAY)			ENERGY SAVED	COST SAVED
MONTH	DAY	MCF	COSTS	PER MCF	DEG C	PRESENT	HISTORIC	SAVINGS	(MCF)	($)
JUNE	4									
JULY	8	734.8	3256.98	4.43	17.7	21.61	18.99	-2.62	-89	-394.46
AUG	5	593.1	2640.86	4.45	22.36	21.18	15.33	-5.85	-164	-729.73
SEPT	9	818.2	3619.68	4.42	17.97	23.38	18.78	-4.60	-161	-711.51
OCT	6	779.6	3451.91	4.43	15.9	28.87	21.50	-7.37	-199	-881.35
NOV	10	1954.1	8710.59	4.46	9.99	55.83	55.81	-0.02	-1	-2.76
DEC	8	2479.8	11408.57	4.60	5.57	88.56	81.48	-7.09	-198	-913.21
JAN	6	3214	15620.78	4.86	.17	110.83	110.14	-0.68	-20	-96.34
FEB	9	4226	20588.99	4.87	-2.92	124.29	119.25	-5.04	-171	-835.74
MARCH	10	3114	15223.64	4.89	1.21	107.38	107.08	-0.30	-9	-42.48
APRIL	7	2546.4	12578.42	4.94	1.99	90.94	95.09	4.15	116	573.98
MAY	5	1853.8	9070.66	4.89	7.98	66.21	66.60	0.39	11	54.10
JUNE	4	1425.4	7015.29	4.92	11.69	47.51	48.96	1.44	43	212.98
TOTALS FOR PERIOD:		23739.2	113186.4						-841	-3766.50

AVERAGE CONSUMPTION IN MCF/DAY (HISTORIC) IS CALCULATED FROM "OUTDOOR AV. TEMP" AND THE HISTORIC RELATIONSHIP BETWEEN "AVERAGE CONSUMPTION" AND "OUTDOOR AV TEMP
"OUTDOOR AV. TEMP" IS THE AVERAGE OUTDOOR TEMPERATURE DURING THE BILLING PERIOD

ENERGY COST SAVINGS: $ -3766.50 -3.33 % OF COST $ -15.44 PER SUITE

FOR FURTHER INFORMATION CONTACT THE ENERGY BILL ANALYSIS DEPARTMENT OF:
ADMIC CONTROLS, UNIT 2, 33 GLENCAMERON ROAD, THORNHILL, ONTARIO, L3T 1N9 TEL (416) 881 4112

APPENDIX E

Energy Analysis: Electricity

1765 Weston Road October 1981 - June 1982

1765 Weston Road July 1982 - May 1983

1775 Weston Road October 1981 - June 1982

1775 Weston Road July 1982 - May 1983

ADMIC CONTROLS — ELECTRICITY REPORT

BUILDING ELECTRICAL ENERGY PERFORMANCE STUDY FOR THE PERIOD SEPT 1981 TO JUNE 1982

LOCATION: 1765 WESTON ROAD, WESTON — SIZE(SQ.METERS) — NO. OF SUITES 245

******** ENERGY BILL INFORMATION ********** — ********** CALCULATED VALUES **********

READING DATE		ENERGY CONSUMED	PEAK DEMAND	TOTAL ELECT	AVERAGE TEMP	AVERAGE POWER (KW)			PEAK DEMAND (KW)		ENERGY SAVINGS	DEMAND SAVINGS
MONTH	DAY	KWH	KW	COSTS	DEG C	PRESENT	HISTORIC	SAVINGS	HISTORIC	SAVINGS	DOLLARS	DOLLARS
JUNE												
JULY												
AUG	31											
SEPT	30	140000	352	4262.65	16.26	194	196	1	326	-26	21.87	-62.84
OCT	30	148000	344	4438.65	8.22	206	204	-1	357	13	-22.91	30.49
NOV	30	160000	312	4654.65	5.33	215	209	-6	359	47	-106.05	112.89
DEC	31	164000	356	4857.85	-1.02	220	220	0	364	8	-5.78	19.62
JAN	29	156400	444	5456.30	-7.73	225	224	0	369	-75	-8.62	-194.18
FEB	26	162000	374	5428.30	-4.69	241	225	-16	364	-10	-295.90	-25.86
MARCH	30	180400	360	5897.90	-.6	235	226	-9	357	-3	-185.08	-7.85
APRIL	30	156000	340	5174.90	6.09	210	193	-16	334	-6	-334.26	-15.73
MAY	31	156000	298	5065.70	15.25	210	196	-14	316	18	-288.74	47.75
JUNE	30	146800	308	4838.70	16.68	204	196	-8	314	6	-157.94	14.61
TOTALS FOR YEAR		1569600	3488	50075.6					ANNUAL SAVINGS		-1383.41	-81.10

AVERAGE POWER (HISTORIC) IS CALCULATED FROM THE "AVERAGE TEMP" AND THE HISTORIC RELATIONSHIP BETWEEN "AVERAGE POWER" AND "AVER TEMP".
HISTORIC PEAK DEMAND IS CALCULATED IN A SIMILAR MANNER.
"AVER TEMP" = AVERAGE OUTDOOR TEMPERATURE DURING THE BILLING PERIOD.

TOTAL ENERGY SAVED: -50827 KWH — TOTAL DEMAND SAVED: -28 KW

TOTAL ELECTRICITY COST SAVINGS: -1464.51 DOLLARS PER YEAR

OR: -5.98 DOLLARS PER SUITE

COST SAVINGS AS PERCENT OF TOTAL ELECTRIC BILL = -2.92

FORMULA FOR MONTHLY ENERGY CHARGES: COST IN DOLLARS = 2.4 * DEMAND (KW) + .0244 * ENERGY (KWH) JAN TO DEC 1981

2.6 * DEMAND (KW) + .0275 * ENERGY (KWH) JAN TO DEC 1982

ADMIC ELECTRIC ENERGY PERFORMANCE REPORT FOR THE PERIOD JULY 1982 TO JUNE 1983

LOCATION: 1765 WESTON ROAD, WESTON NO. OF SUITES: 245

******** ENERGY BILL INFORMATION ********** ******** CALCULATED VALUES **********

READING DATE MONTH	DAY	ENERGY CONSUMED KWH	PEAK DEMAND KW	TOTAL ELECT COSTS	LOAD FAC PERCENT	AVERAGE POWER KW	ENERGY SAVED KWH	DEMAND SAVED KW	ENERGY SAVINGS DOLLARS	DEMAND SAVINGS DOLLARS
JUNE	30									
JULY	30	150000	312	4937.10	66.77	208	-4188	-28	-115.18	-72.95
AUG	31	154800	302	5043.10	66.74	202	-1880	3	-51.69	7.29
SEPT	30	147200	356	4974.50	57.43	204	-6376	-30	-175.34	-76.88
OCT	29	146400	324	4869.30	64.92	210	-8148	30	-224.06	78.15
NOV	30	166800	362	5584.10	60.00	217	-7259	-4	-199.62	-9.51
DEC	31	167600	368	5566.70	61.21	225	-8230	-7	-226.32	-17.18
JAN	31	173200	388	6107.12	60.00	233	-5287	-28	-154.38	-75.86
FEB	28	156800	388	5628.24	60.14	233	-4968	-30	-145.05	-80.34
MARCH	31	166800	360	5844.64	62.28	224	2003	-8	58.48	-21.56
APRIL	29	150800	343	5301.84	63.17	217	-16149	-10	-471.55	-27.08
MAY	31	148400	339	5512.96	57.00	193	1050	-15	30.65	-40.43
JUNE	30	149600	339	5256.00	61.29	208	-8006	-31	-233.79	-84.44
TOTALS FOR PERIOD		1878400	4181	64625.60			-67438	-157	-1907.86	-420.78

SAVINGS ARE CALCULATED FROM THE DIFFERENCE BETWEEN PRESENT ENERGY USE AND THE HISTORICAL USE UNDER THE PRESENT AVERAGE OUTDOOR TEMPERATURES

TOTAL ELECTRICITY COST SAVINGS: $ -2328.65 OR $ -9.50 PER SUITE OR -3.60 %

FORMULA FOR MONTHLY ENERGY CHARGES: (DOLLARS) 2.6 * DEMAND .0275 (KWH) JAN-DEC 1982

2.7 * DEMAND .0292 (KWH) JAN-DEC 1983

FOR FURTHER INFORMATION CONTACT THE ENERGY BILL ANALYSIS DEPARTMENT OF:
ADMIC CONTROLS, UNIT 2, 33 GLENCAMERON ROAD, THORNHILL, ONTARIO, L3T1N9, TEL (416) 881-4112

ADMIC CONTROLS — ELECTRICITY REPORT

BUILDING ELECTRICAL ENERGY PERFORMANCE STUDY FOR THE PERIOD SEPT 1981 TO JUNE 1982

LOCATION: 1775 WESTON ROAD, WESTON — SIZE(SQ.METERS) — NO. OF SUITES 245

READING DATE		ENERGY CONSUMED	PEAK DEMAND	TOTAL ELECT	AVERAGE TEMP	AVERAGE POWER (KW)			PEAK DEMAND (KW)		ENERGY SAVINGS	DEMAND SAVINGS
MONTH	DAY	KWH	KW	COSTS	DEG C	PRESENT	HISTORIC	SAVINGS	HISTORIC	SAVINGS	DOLLARS	DOLLARS
JUNE												
JULY												
AUG	31											
SEPT	30	120000	280	3601.85	16.26	167	171	4	274	-6	78.85	-14.11
OCT	30	128000	239	3806.65	8.22	178	184	7	293	54	115.20	129.14
NOV	30	136000	271	4078.65	5.33	183	184	1	299	28	21.25	66.20
DEC	31	143600	304	4235.29	-1.02	193	183	-10	311	7	-178.90	17.44
JAN	29	135200	380	4706.90	-7.73	194	201	6	312	-68	123.09	-176.84
FEB	26	134000	308	4486.70	-4.69	207	193	-13	317	9	-236.89	22.28
MARCH	30	153200	308	5014.70	-.6	199	184	-16	323	15	-330.56	38.32
APRIL	30	130400	292	4346.10	6.09	175	189	13	289	-3	272.93	-8.95
MAY	31	129200	268	4250.70	15.25	174	170	-4	270	2	-77.26	4.95
JUNE	30	121200	268	4030.70	16.68	168	167	-1	267	-1	-27.28	-2.62
TOTALS FOR YEAR		1330800	2918	42558.24					ANN'JAL SAVINGS		-239.57	75.82

AVERAGE POWER (HISTORIC) IS CALCULATED FROM THE "AVERAGE TEMP" AND THE HISTORIC RELATIONSHIP BETWEEN "AVERAGE POWER" AND "AVER TEMP".
HISTORIC PEAK DEMAND IS CALCULATED IN A SIMILAR MANNER.
"AVER TEMP" = AVERAGE OUTDOOR TEMPERATURE DURING THE BILLING PERIOD.

TOTAL ENERGY SAVED: -9544 KWH — TOTAL DEMAND SAVED: 36 KW

TOTAL ELECTRICITY COST SAVINGS: -163.76 DOLLARS PER YEAR

OR: -0.67 DOLLARS PER SUITE

COST SAVINGS AS PERCENT OF TOTAL ELECTRIC BILL = -0.38

ADMIC ELECTRIC ENERGY PERFORMANCE REPORT FOR THE PERIOD JULY 1982 TO JUNE 1983

LOCATION: 1775 WESTON ROAD, WESTON

NO. OF SUITES: 244

******** ENERGY BILL INFORMATION ********** ******** CALCULATED VALUES **********

READING DATE		ENERGY CONSUMED	PEAK DEMAND	TOTAL ELECT	LOAD FAC	AVERAGE POWER	ENERGY SAVED	DEMAND SAVED	ENERGY SAVINGS	DEMAND SAVINGS
MONTH	DAY	KWH	KW	COSTS	PERCENT	KW	KWH	KW	DOLLARS	DOLLARS
JUNE	30									
JULY	30	131600	268	4316.70	68.20	183	-1393	13	-38.29	34.31
AUG	31	137200	264	4460.30	67.67	179	-2019	14	-55.52	35.55
SEPT	30	132800	312	4464.10	59.12	184	-9671	-38	-265.95	-98.75
OCT	29	133600	296	4444.50	64.85	192	-5012	-10	-137.83	-25.28
NOV	30	153200	322	5051.10	61.95	199	-11829	-25	-325.31	-65.35
DEC	31	149600	324	4957.30	62.06	201	-13004	-20	-357.62	-51.03
JAN	31	152400	364	5434.96	56.27	205	-12677	-44	-370.18	-118.25
FEB	28	136400	336	4892.16	60.41	203	-11708	-14	-341.88	-38.78
MARCH	31	150000	328	5267.68	61.47	202	-18280	-1	-533.79	-2.52
APRIL	29	133200	305	4690.72	62.75	191	-2654	-17	-77.51	-47.20
MAY	31	140800	305	4912.64	60.11	183	-4067	-27	-118.76	-72.82
JUNE	30	133600	283	4643.00	65.57	186	-17911	-22	-523.01	-60.11
TOTALS FOR PERIOD		1684400	3707	57535.16			-110227	-191	-3145.65	-510.21

SAVINGS ARE CALCULATED FROM THE DIFFERENCE BETWEEN PRESENT ENERGY USE AND THE HISTORICAL USE UNDER THE PRESENT AVERAGE OUTDOOR TEMPERATURES

TOTAL ELECTRICITY COST SAVINGS: $ -3655.86 OR $ -14.98 PER SUITE OR -6.35 %

FORMULA FOR MONTHLY ENERGY CHARGES: (DOLLARS)

2.6 * DEMAND .0275 (KWH) JAN-DEC 1982

2.7 * DEMAND .0292 (KWH) JAN-DEC 1983

FOR FURTHER INFORMATION CONTACT THE ENERGY BILL ANALYSIS DEPARTMENT OF:
ADMIC CONTROLS, UNIT 2, 33 GLENCAMERON ROAD, THORNHILL, ONTARIO, L3T1N9, TEL (416) 881-4112